median, longitudinal ridge; tibiæ finely spinulose; anterior femora incrassated with three prominent spines beneath at apex.

Long. 17 mm.

Hab. South India; Coimbatore (*T. V. Campbell*).

Syncrotus circumscriptus, Bergr. Proc. Roy. Soc. Vict. vii. p. 293 (1895).

Bergroth described this genus and species from a ♀ or ♀ specs., and his description requires some emendation. In the male the membrane reaches the abdominal apex and is considerably smaller than the other sex. "Rufo-castaneus" cannot be accepted as the predominant colour as stated by Bergroth, for the head and pronotum, in some cases the anterior lobe only, are black.

Long., ♂ 6, ♀ 9 mm.

Hab. Queensland; Kuranda (*F. P. Dodd*).

XX.—*Some Parthenogenetic* Chironomidæ.

By F. W. Edwards.

So far as our present knowledge goes, parthenogenesis is of somewhat rare occurrence among the Diptera, but several instances of it have already been recorded in Chironomidæ, in the genera *Tanytarsus* and *Corynoneura*. In the case of *Tanytarsus* the first observations were made by Grimm in 1870, and have more recently been confirmed and extended by Zavrel (*vide* Bause, Archiv für Hydrobiol., Suppl. Bd. ii. 1913, p. 17). The observations of both these writers concern the rare phenomenon of pupal parthenogenesis. Zavrel found that in the summer broods of *Tanytarsus boiemicus*, Kieff. MS., eggs could be produced parthenogenetically either by the pupa or by the imago very shortly after emergence; the pupæ were often found floating dead on the water full of developing eggs, from which larvæ eventually hatched. In all cases the adults reared from such larvæ proved to be females.

Another case of parthenogenesis—in this instance of a more normal type—has been recorded by Goetghebuer as occurring in *Corynoneura celeripes*, Winn. (Bull. Acad. Roy. Belg. 1913, pp. 231-233). This author was able to rear three successive generations of parthenogenetically produced eggs, which in every case yielded female adults.

These, I believe, are the only cases so far placed on record of the occurrence of parthenogenesis in this family of the Diptera ; but I am now able to add two others.

Chironomus clavaticrus, Kieffer.

(*Tanytarsus flexilis*, Bause, ? Linné.)

During the month of May 1917 I collected some weeds and mud from a pond at Letchworth, Herts, in the hope of being able to discover the larvæ of certain Culicidæ, but was then only able to rear various species of Chironomidæ from the material. Among these were a number of specimens of a species which I determined later as *Chironomus clavaticrus*, Kieff. (Bull. Soc. Nat. Hist. Metz, xxviii. 1913, p. 17). My interest in these was aroused in the first place by the fact that this very distinctively marked species had not been recorded from Britain, and was quite unrepresented in the collections at the British Museum and at Cambridge. Secondly, it was noticeable that all the specimens which hatched (about forty) were females. Suspecting that this might be a case of parthenogenesis, I isolated a few pupæ in a small closed receptacle. Two females hatched, and each of these deposited an egg-mass. From these eggs larvæ developed which produced female adults on August 16 ; eggs were laid parthenogenetically on Aug. 18, and produced larvæ on August 23. These for the most part died young, owing, I believe, to lack of food ; a few lived through the winter and became full-grown in June 1918, but for some reason unknown to me no adults hatched from them.

I made a diligent search by sweeping with a net in the neighbourhood of the pond where the larvæ were obtained, but succeeded in finding only female specimens, and am inclined to believe that in this locality at least no males occur. It is interesting to note that the species was originally described by Kieffer from females only, reared from larvæ by Thienemann. It was also reared by Réaumur from larvæ collected near Paris ; he figures the larva and the female adult (Hist. Ins. iii. p. 179, pl. xiv. figs. 11–16). No other records of the adult of *C. clavaticrus* have been made, and the species is thus known only in the female sex at present.

The discovery of the male—supposing it to exist—would be a matter of some interest, since it might give a further clue to the correct generic position of the species. From the characters of the adult female alone, and particularly on account of the entirely bare wings, Kieffer was no doubt

justified in allocating it to *Chironomus*, but in its larval and pupal stages the species shows a much greater relationship to *Tanytarsus*. The early stages of *C. clavaticrus* have, indeed, been described in detail by Bause (Archiv für Hydrobiol., Suppl. Bd. ii. p. 73, 1913) * as those of a *Tanytarsus*, which, on the authority of Thienemann, he calls "*Tanytarsus flexilis*, Linné," though he states that the larvæ have not yet been reared. Why Thienemann adopts this name, which has usually been allotted to a totally different species of *Chironomus*, is far from clear; but, since Bause states that Thienemann himself intends to give reasons for the identification in a later publication, I refrain from comment at present.

To the accounts given by Réaumur, Lauterborn, and Bause of the early stages of this species I can add the following points:—The egg-mass is about 6 mm. in length, 1 mm. broad, pointed at each end; those I observed adhered by one end to water-weeds, but whether this was accidental or whether they were fixed in this position by the fly I could not determine. The eggs in the egg-mass are arranged in a rather indefinite spiral; counts of the number in two separate masses showed 182 and 163 respectively. The larvæ emerge from the egg through a longitudinal fissure, and when newly hatched are about 0·6 mm. long and practically colourless, there being only small patches of yellowish-green granules at the sides of abdominal segments 2–7 and along the sides of the intestine; they have no trace of ventral blood-gills or of the hump on the eighth abdominal segment; "Lauterborn's organs" are present at the apices of the second and third antennal joints, as in the full-grown larva. The second stage larva much resembles the first †, but is a little over 1 mm. long, and has a slight hump on the eighth abdominal segment and a slight red tinge behind the head and in the middle of the body. In the third stage the red colour of the body is more widely spread, but not strong; the hump on the eighth abdominal segment is well developed, and blood-gills are present on the seventh segment, but are as yet colourless and have not their full length. The

* The early stages of *C. clavaticrus* apparently agree in every respect with Bause's description and figures of *T. flexilis*, but there is, of course, a possibility that there may be two closely allied species.

† Miall and Hammond state ('Harlequin-fly,' p. 176) that the peculiarities of the newly-hatched larva disappear after the *first* moult. It is just possible that what I regarded as second-stage larvæ are merely first-stage individuals which have grown in size.

newly hatched larva, as soon as it has freed itself from the jelly of the egg-mass, loses no time in making itself a case. I was not fortunate enough to observe the process of formation, but apparently these cases consist chiefly of salivary secretion, to which minute particles adhere. Since I could never find any small empty cases, I am led to believe that the larva increases the size of the original case as it grows; but more observations are needed on this point, since the material of the case does not seem to be particularly elastic. The larva can turn completely round in its case and protrude its head from either end; in moving about from place to place it sometimes comes out as far as the fifth or sixth abdominal segment, but I never saw one completely leave its case—in fact, it is probable that the hump on the back of the eighth and the large ventral blood-gills on the seventh segment would prevent its being able to do so.

Before pupation the larva usually moors its case by one end in such a position that the other end is close to or touching the surface of the water. The pupa leaves the larval case only a short time before the emergence of the adult (I have not seen a free pupa, but have only found the skins floating on the surface of the water). A very noteworthy point is that the larva skin seems never to be completely shed, but remains attached to the abdomen of the pupa; pupæ removed from their cases, as well as cast pupal skins collected on the surface, always had the larval skin attached *.

The adult, when freshly emerged, has still much of the blood-red colour of the larva—which, indeed, is the case with other Chironomidæ having blood-red larvæ. Another point worthy of special remark is the resting position of the adult fly, the front legs being held in a peculiar manner which I have not observed in any other Chironomid. The front femora are directed straight forwards, so that their clubbed tips almost or quite touch in front of the head; the tibiæ and tarsi are bent right back at an angle of about 40° with the body. A somewhat similar posture is adopted by some small species of *Tanytarsus*, which hold their front tibiæ and tarsi at right angles to the body; but I do not know of another instance in the Chironominæ in which the normal manner of holding the front legs is departed from.

* Miall and Hammond, in their monograph on the 'Harlequin-fly' (p. 139), note that "*occasionally* the larval skin is still adherent to the pupa when the fly emerges."

Corynoneura innupta, sp. n.

Though this species is not at all uncommon in the Letchworth district of Hertfordshire, it appears not to conform to any of the published descriptions of European species; it may be diagnosed as follows:—

♀. General colour bright yellow. *Head* black behind; face brownish yellow; palpi yellow; antennæ six-jointed, basal joint black, joints 2–5 yellow, oval, not quite twice as long as broad; last joint somewhat darkened, pointed, more than three times as long as broad. *Thorax* yellow; mesonotum with three rather widely separated black stripes, the middle one extending from the front margin halfway to the scutellum; base of scutellum, apical half of postnotum, also the mesosternum blackish. *Abdomen* yellow; the tergites rather broadly blackish grey towards the base. *Legs* pale; extreme tips of femora, tibiæ, and tarsal joints rather indistinctly darkened; front tibia about 1·7 times the length of the metatarsus. *Wings* clear; R extending very slightly beyond the middle of the wing; Cu forking noticeably beyond the tip of R.

Length 0·9 mm.

C. innupta must evidently bear a close general resemblance to *C. scutellata*, Winn., and *C. pumila*, Wulp (both of which are unknown to me), but these two are said to have the scutellum yellow at the *base* instead of the apex, and there are some other points in the published descriptions which seem to indicate that our insect cannot be the same as either.

In the autumn of 1917 I reared a few females of this species from the same pond from which I had obtained *Chironomus clavaticrus*. Again, in the spring of 1918 *Corynoneura* larvæ appeared in a breeding-jar for mosquito-larvæ. These latter were collected in a temporary puddle in a copse at Arlesey, Beds, and were supplied with dead leaves and water from a ditch (also temporarily full) in my garden at Letchworth. I do not know from which locality the *Corynoneura* larvæ originated. I have also swept female specimens from vegetation at the lakeside at Radwell, Herts.

From the larvæ in this jar, which was kept closed the whole time, about fifty specimens emerged in the early part of June, all of which were females; probably they were the offspring of a specimen which hatched unnoticed earlier in the year, since the material was collected early in April. Some of the pupæ were isolated, and both the specimens which hatched from them and the others in the main receptacle deposited egg-masses which produced larvæ about

June 19. Between July 5 and July 14 about seventy adults had hatched from these larvæ, again all females; these, again, produced egg-masses parthenogenetically, and another generation of flies (twenty specimens, all females) appeared at the end of July. A third parthenogenetically produced generation appeared about August 20 and a fourth about August 31. From this time until early October flies and larvæ were almost continually present (though in decreasing numbers), so that it became impossible to distinguish the separate generations; but it would be safe to say that there were at least five parthenogenetic generations during the year, and though a careful watch was kept on the breeding-jar, no males were seen.

The metamorphoses of *Corynoneura* are well known, and nothing need be said concerning this species, except that the food of the larvæ appeared to consist of rather large infusoria (*Paramecium*?) which swarmed in the breeding-jar. The larvæ could be watched under a lens apparently chasing the infusoria, though I could never be quite certain that they swallowed them. When the numbers of the infusoria diminished, the *Corynoneura* larvæ also became much scarcer. Both had disappeared entirely by the middle of October.

During the summer of 1918 I also reared a small number of males and females of *Corynoneura celeripes*, Winn. (or what I believe to be this species), from the pond which had provided me in 1917 with the first *C. innupta*, and also earlier with *Chironomus clavaticrus*. This species (*Corynoneura celeripes*), as already mentioned in the introduction, has been found by Goetghebuer to be occasionally parthenogenetic *, but I could obtain no evidence that such was the case with any of my specimens. Newly hatched females isolated in separate tubes did not deposit egg-masses, nor did they do so after males had been placed in the tubes with them. It would appear that in this locality *C. celeripes* has not the power of parthenogenesis, and the fact that I failed to obtain any eggs at all may be explained by the not unlikely assumption that it will not pair except under certain natural conditions.

The species which I regard as *C. celeripes* appears to be

* Since the European species of *Corynoneura* have not yet been critically studied, it is, of course, possible that Goetghebuer's species was really the same which I have here described as *C. innupta*, rather than the one I regard as *C. celeripes*. Should that be the case, there is nothing new in my observations, but they would still form an interesting confirmation of Goetghebuer's.

identical with *C. innupta* in all structural characters, differing only in the much blacker colour of the whole body, which is exhibited particularly in the broad confluent mesonotal stripes. It is a matter for speculation whether *C. innupta* may not be a pale parthenogenetic form of *C. celeripes*. However, it would seem to be impracticable to test this possibility, since the male *celeripes* (=*atra*, Winn.) appears equally indifferent in captivity to females of *celeripes* or *innupta*.

In considering the question of parthenogenesis in *Corynoneura*, it may not be out of place to mention that a species exists in this country in which the males and females are similar in coloration, and in which, moreover, the male antennæ are hardly more hairy than those of the female. Bred specimens of this species (which is apparently undescribed) were sent me by Prof. J. W. Carr in 1914, and, being under the impression that all were females, I was at first inclined to regard this as another possible case of parthenogenesis; it was only on mounting a specimen for detailed study that presence of males was discovered. In the case of *C. innupta*, however, the occurrence of parthenogenesis is indisputable; since the females hatched from isolated pupæ produced eggs, there is no room for error on account of similarity of the sexes.

The question as to the origin of parthenogenetic species or varieties is too obscure to be profitably discussed, but, given the existence of forms which are capable of asexual reproduction, it is easy to understand how the male sex may be eliminated in a part or in the whole of the range of the species. It has been pointed out by Williams* that many insects will not pair except under special conditions of space, heat, moisture, etc., and that under the abnormal conditions encountered in Nature by the spread to new localities of a female-producing parthenogenetic race, the male sex may be gradually lost. According to this suggestion, the apparent non-existence of males of *C. clavaticrus* (and perhaps of *C. innupta*) might be due to their having spread from some centre where both sexes existed, and where conditions were favourable to pairing. Another possible explanation would be that climatic conditions prevented pairing during the whole of one flight-season, leaving only unfertilized females to perpetuate the species.

* C. B. Williams, "Some Problems of Sex Ratios and Parthenogenesis," Journal of Genetics, vi. 1917, pp. 255-257.